Challenges for LSTK Contractor for Executing Large scale Brownfield Project in Oil Refinery

Many times, while executing the revamp project, the things that are not supposed to fail can also fail. The authors discuss some of the standard execution strategies across all stages of project execution out of available options to work on large scale refining projects in this article.

Type of Project Execution Philosophy:

- EP Mode: EP (Engineering and procurement) mode of execution, Owner sub-contracts engineering and procurement services to the Contractor. Construction and implementation of the Project is taken up by the Owner. Owner prefers this philosophy if they have significant internal resources available for executing the Project.
- EPCM Mode: EPCM (Engineering Procurement Construction Management) mode of execution, Consultant scope is engineering services, procurement services and construction management of the Project. Consultant plans and supervises construction activities and is responsible for the implementation of work and management of the Project. EPCM Consultant follows the Owners Procurement and Sub Contracting procedures for ordering and tendering process. Selection of vendor, supplier, sub-contractor and execution of work lies with Owner based on EPCM consultant recommendation. The Owner places the Purchase Orders and Work orders on the Vendors /Contractors and Pays to these agencies as well. Cost risk remains with the Owner under this arrangement.
- EPC Mode: EPC (Engineering Procurement Construction) mode is often known as turnkey contract. In this mode of project execution, contractor scope includes complete Engineering services, Procurement activity and Construction activity on the lumpsum basis. Risk under this mode of the contract remains primarily with EPC Contractor. EPC Contractor enters into separate agreements with sub-contractors / vendors; however, it retains the responsibility of their work. Owner minimizes its risk under EPC mode of contract, and this arrangement is well suited when the Owner has limited execution resources and tight schedule for finishing project.

Challenges for EPC Contractor:

There are several challenges for EPC contractor for Brownfield project execution. In this chapter, the author shares his practical experience in some of the significant challenges faced by EPC contractor while executing Brownfield project in LSTK mode during different stage of the Project, i.e. Proposal, Design, Construction and finally Pre-commissioning, commissioning and start-up phase.

Proposal Stage:

- Steep competition: LSTK Contractors often face fierce competition with other bidders during the bidding process; competitors are aggressive with their pricing. In some instances, LSTK Contractors are awarded job with a marginal difference in pricing with their competitor. In most of the tender costing of the job is a combination of OPEX and CAPEX, LSTK Contractors to give equal weightage for both while deciding the price for bidding.
- Tendering time: The duration of bidding time for EPC tenders is often tight and sometimes tendering period is only 2-3-months. Due to lack of time contractor may go for inhouse costing of some of the items which may deviate during execution stage leading to loss.
- Interface issues with Owner: One of the significant problems with Brownfield projects is the Interface between the Owners and Contractors scope of work. The scope demarcation is not always clear, and LSTK Contractor ends up

doing more work during execution than estimated

- Zero deviation contract: Often, most of the Oil Refineries prefer zero deviation in the tender. EPC contractor to sign the agreement as per the condition of the Owner. Most of the contracts are one-sided, and all significant risks and uncertainties are moved to the Contractor's scope.

- Feed verification: Before proceeding for EPC contract, Oil Refineries perform FEED which gives a clear understanding of the scope of work for LSTK Contractor. In many cases, the design is not frozen in the FEED stage, and LSTK contractor has to re-verify the FEED package during the proposal stage and clarify doubts in the form of Technical queries (TQs). However, there are always grey areas for which Owner/ PMC does not provide straight forward clarifications. It becomes a complicated situation to deal with in the execution stage; Costing of such issues becomes very difficult and impose a risk to the bidder.

- Proposal Budget: LSTK Contractors have a fixed budget for proposals. Contractors spend manhour in the bidding process if the proposal not successful, then it will be a loss for the LSTK contractor.

Design Stage:

- Schedule monitoring: LSTK contractor to develop level-4/level-5 schedule during the early stage of project execution and ensure it is in line with the achievement of critical milestones. EPC Contractor to conduct monthly review meeting with Client/PMC and monitor project progress is as per plan.

- Long delivery items: There are few items in the Brownfield project having the long delivery time and govern the schedule of the contract. Contractor to identify these items and ordering to be done at early stage of Project so that these items reach site on time.

- Critical Review meetings: LSTK contractor conducts various review meetings like P&IDs review meeting, 3D model review meeting etc. LSTK Contractor records meeting notes and ensure all points are closed on time. In these review meetings, apart from technical aspects; LSTK contractor's prime focus is to ensure compliance of all scope as per bid package.

- HAZOP/HAZID/SIL Study: LSTK Contractor to conduct HAZOP/ HAZID/SIL study and ensure all action items are closed. The delay of the closure of action item can impact the overall project schedule. HAZOP/SIL study is also to be conducted for the vendor package items.

- Existing Plant Health: Existing plant health is another concern for the Brownfield plant. LSTK Contractor rely upon the health check data / adequacy report provided by the Owner in the BID document. Measuring the thickness of existing line/equipment while the plant is under operation is not an easy task. LSTK contractor to make site visits and take feedback from Owner to assess the health condition of the plant at the early stage of the Project. In case of any significant concern, the same to be discussed with the Owner for finding a suitable solution.

- As-built verification: Existing unit's As-built document/drawing verification is one of the significant challenges for LSTK contractors. As-built P&IDs, Piping isometrics, GA drawing, Control logics etc. needs to be verified by LSTK contractor at the early stage of the Project. In many cases, the document available in the bid document will not be in line with the actual plant. LSTK Contractor must-visit site for verification of as-built documents. Sometimes 3D models, native files of the P&IDs are not available with the client, LSTK contractor can consider advance technology like Laser scan of the plant etc. Still, there are few cases like UG lines, Internals of columns/Reactors/ vessel etc. for which Contractor is dependent on the Owner as-built document; as verification is difficult or not possible.

- Tie-In verification: In brownfield projects, Interface of the new lines with existing lines are called Tie-In. These Tie-ins need to be indicated with a tie-in no in the P&IDs and isometrics. Location of the tie-ins to be verified at the site by contractor process and piping engineers to ensure these tie-ins can be executed during turn-around. If specific tie-ins are found difficult to perform during site tie-in verification, these tie-in locations should be changed. This exercise needs to be completed will 100% accuracy level, which is key for successful revamp of units.

- Constructability Study: In typical brownfield projects, there are few pieces of equipment which needs to be replaced in the same location or new location; few pieces of equipment are to be modified. There are cases of critical modifications where Contractor to replace tall

columns/vessels with new columns/ vessel in existing structure/location for which constructability study is essential. Constructability study to be conducted in the design stage to ensure equipment erection/ modification/replacement is possible in the given turn-around time.

- Compliance of Local regulations: Compliance to local regulations codes and standards like OISD is another challenge area for Contractor, especially for brownfield project. The units designed decades before are compliant to local regulations at that time. As regulations are updating, it is an opportunity for the Owner to make compliance with all updated regulations. However, in some instances, it is challenging for LSTK contractor to execute.

- Handling the OEMs: In some instances, LSTK Contractors have no option but to contact existing equipment manufacturer called OEMs in Brownfield projects to verify existing equipment for its adequacy for revamp scenario or to modify the existing equipment to suit revamp case. For example, adequacy of existing compressor needs to re-evaluate for the revamp operating condition. These types of works are shifted from Feed stage to EPC stage, by Owner, to save overall project execution time. As a result of adequacy check, certain unforeseen surprises can occur, which may have high cost and schedule impact to the LSTK contractor and becomes a risky proposition.

- Pre-com, Com and Start-up plan: The LSTK contractor to freeze Pre-commissioning, Commissioning and Start-up plan of the Project. The LSTK contractor discusses more elaborately with the Owner for the sequence of start-up activity. LSTK contractor to involve process licensor in these meetings to finalize the plan so that there will be no last min surprise during commissioning and start-up. Planning of pre-shutdown activities during the design stage is very critical. It is very much essential to prepare adequately in the design phase such that no pre-shutdown activities should overflow during the turn-around, causing delays to the project schedule.

Construction Stage:

- Segregation of Pre-shutdown and Shutdown work front: Construction stage is crucial for the successful execution of the brownfield project. LSTK contractor to segregate the construction work front into two types, i.e. prior-turn-around and during turn-around work front.

- Execution of work prior turn-around: Execution of work prior turn-around relatively more straightforward than during turn-around. LSTK contractor to select sub-contractor, ensure availability of material and resources to perform work front. LSTK Contractor's objective is to maximize work in pre-shutdown stage and lesser work in the shutdown stage to complete the brownfield project successfully. LSTK Contractor to take advantage of opportunity shutdown, i.e. intermediate shutdown of the units by Owner.

- Execution of work during turn-around: This is the most crucial time for the Contractor. Contractor to work in limited time considering all safety aspect of the plant. Any violation of safety can have a severe impact.

- Vendor Management: LSTK contractor to manage multiple vendors mobilization in the site during turn around, for overseas vendors mobilization, government approval is required. LSTK contractor to take proper permissions in advance for their visit.

- HSE: Ensure all HSE metrics are monitored in the site during execution of work as per LSTK contractor/Owner HSE procedure.

- Multiple agencies working in the same plant: Owners Maintenance team also perform their activity in the same plant during the turn-around, which will have interface issues for the LSTK contractor.

- Material Management: Local well-organized Storage at the site is crucial as several activities by numerous groups will be parallelly going around, and material management is going to be most challenging in the shutdown period.

- Shutdown Challenges: During the shutdown, when LSTK contractor executes the modification of existing systems, some internal damages may show up and will surprise the Contractor and Owner. Resolving such surprises may derail the shutdown schedule and possess the risk to the LSTK contractor.

- Critical Equipment: Preservation of critical and sensitive equipment's during the construction phase is one of the key points to ensure a quick and smooth start-up and to avoid any surprises during the commissioning period.

Expert Advise

Meticulous planning of commissioning activities. construction activities, pre-commissioning activities is must

Provide additional spools, positive isolations so that parallel activities can be conducted without their interference.

At the design stage itself, Licensor or Basic Design engineer must be consulted for the critical issues.

Many times, while executing the revamp project, the things that are not supposed to fail can also fail. In such cases new operation methods need to be developed so that the sequence of operation does not stop.

Any new operation needs to be discussed in detail, design and all necessary approvals must be taken before implementation.

Risk analysis must to be done to ensure that there are no loopholes.

- Unit Handover: Before handing over of unit by Owner to Contractor, units should be made hydrocarbon free, and suitable blinds are to be provided for positive isolation to ensure units are safe to start construction work. Several safety risks are associated if the Owner does not fulfil the above conditions.
- Tough work environment during the shutdown period: Considering that many contractors are competing to finish their respective scopes compete for limited space available in the plant. This creates a challenging situation to maintain a tidy work environment. At times this could affect the quality of work and the consequent problems.

Pre-commissioning-Commissioning and Start-up:

- Pre-commissioning: Pre-commissioning activity is performed along with Owner Operating team. Depending on the contractual requirement, in most of the brownfield project Owner takes the responsibility of Pre-commissioning and commissioning activity. In some cases, these activities are undertaken by the LSTK Contractor. The entire plant is divided into systems and subsystems, pre-commissioning activities are conducted system-subsystem wise. LSTK Contractor to approve pre-commissioning plan much before the start of these activities with Owner. There should be multiple review/meeting to be performed with the Owners' team to finalize Pre-commissioning plan.
- Selection Sub-Contractor: If LSTK Contractor owns resource is not sufficient for pre-commissioning work, Contractor to select suitable sub-contractor for Pre-commissioning activities. Pre-commissioning activity usually is different from construction activity as it is specialized work. There are few special activities like chemical cleaning, alkali boil-out etc. for which Contractor to select specialized vendor/sub-contractor.
- Material/tools and tackles: LSTK contractor should estimate materials for pre-commissioning like gaskets, fastener and tools and tackles with adequate spare margins so that there will be no shortfall.
- Arrangement of Utility: In few brownfield project utility requirements for the pre-commissioning activity is kept under the LSTK contractor scope. Contractor to estimate utility required and make a suitable arrangement.
- Licensor Management: Licensor arrangement is usually under Owner responsibility; however, few Brownfield project it is kept under the scope of LSTK Contractor. LSTK Contractor to maintain an adequate margin on Licensor costing as there can be many uncertainties and licensor services cost is generally high value.

Although there are many difficulties for the LSTK Contractor for implementing Brownfield Projects, with proper planning, execution, and identifying unforeseen risks, it can be successfully executed. On the other, there is a major privilege for Owner as Projects get implemented timely with minimum risk.

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